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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04M 11/00

A1

(11) International Publication Number: WO 98/12862

(43) International Publication Date: 26 March 1998 (26.03.98)

(21) International Application Number: PCT/US97/16753

(22) International Filing Date: 19 September 1997 (19.09.97)

(30) Priority Data:

60/026,408	20 September 1996 (20.09.96)	US
08/932,878	18 September 1997 (18.09.97)	US

(81) Designated States: CA, MX.

Published
With international search report.

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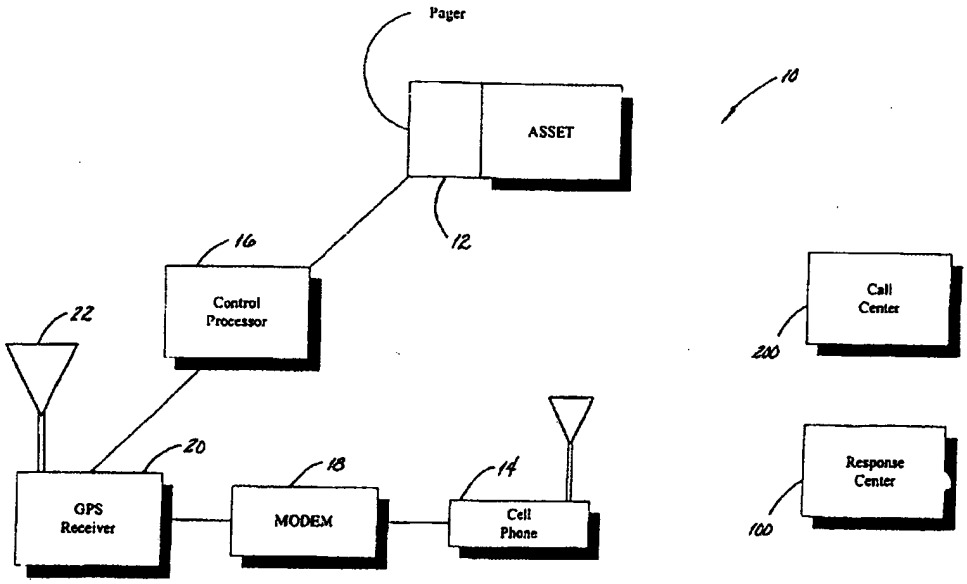
(54) Title: ASSET LOCATION SYSTEM



(57) Abstract

An asset location system includes a pager (12), a control processor (16), a GPS receiver (20) and a cell phone (14). During normal operation, the equipment on board the tracked asset is in a low power or sleep mode. Upon receiving a location quare from a call center (200), a signal to control processor is powered up. If location information is to be obtained from a particular asset, a GPS receiver obtains latitude and longitude information. This latitude and longitude information is put in a transmittable form by a modem (18). A cellular telephone module then transmits this information to a remote monitoring or response center (100). If desired, data reporting on asset condition may also be sent to remote monitoring or response center along with the location information.

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ASSET LOCATION SYSTEM

This application claims the benefit of U.S. Provisional Patent Application, Serial No. 60/026,408 filed September 20, 1996.

Field of the Invention

The present invention pertains to a communication system; more particularly the present invention pertains to a non-voice communication system for determining the location of an asset such as a tractor trailer, a container, construction equipment, P & D trucks, service vehicles, buses, financed vehicles which can be repossessed, etc.

Background

The location of any particular transportable or movable asset in an array of dispersed transportable or movable assets is extremely important to its owner or the entity responsible for the control and maintenance of the assets. Many asset location systems utilize a sophisticated communications regimen in which the asset automatically or periodically reports its location at regular intervals to a central location. Such systems typically have high power requirements and cannot be effectively used in remote areas or in situations where the asset must remain unattended for long periods of time.

Therefore a need remains in the art for a low power, reliable communications system that will provide the location of a transportable or movable asset when needed.

Summary

A lower power system for reliably reporting the location of a transportable or movable asset to a monitoring or response center includes a pager, a signal or control processor, a GPS receiver and a cell phone.

Specifically, when the need arises to determine the location of a particular transportable or movable asset, a wide area pager call is made by a call center to all pagers located on all assets whose location is tracked by the system of the present invention. A pager mounted to the asset passes the incoming call to the signal or control processor. If the incoming call is electronically matched to a particular asset, the signal or control processor energizes the co-located GPS receiver. The co-located GPS receiver then provides a signal containing information describing the physical location of the asset to a modem. In addition, asset condition or status information may be provided to the modem. The location and/or operational status information is then transmitted from the modem by a cellular telephone to a monitoring or response center. Once the transmission of data is complete, the system returns to its lower power or sleep mode.

Brief Description of the Drawing Figure

A better understanding of the Asset Location System of the present invention may be had by reference to the drawing figure wherein:

Figure 1 is a schematic illustration of the operation of the present invention.

Description of the Embodiments

The asset location system 10 of the present invention spends most of its time in a low power or sleep mode. In this low power or sleep mode, the asset location system 10 draws very little current from a power source such as a battery or photovoltaic cell (not shown). When a particular transportable or movable asset is to be located, the asset location system onboard the asset is awakened or activated. Upon activation the asset location system 10 sends physical location data back to a remote monitoring or response center 100.

As shown in Figure 1, the asset location system 10 of the present invention includes a pager 12 which is mounted on the asset to be tracked. While a pager 12 is used in the preferred embodiment, those of ordinary skill in the art will understand that other types of signal receiving means may also be used.

A cellular telephone module 14 is provided for communication with the remote monitoring or response center 100. Information such as GPS location and/or asset condition status data to be sent by the cellular telephone module 14 is delivered to the modem 18. The modem 18 conditions the digital GPS location and/or asset condition status data so that it may be sent over the cellular wireless data transmission communications link. While a cellular telephone communications link is used in the preferred embodiment, it will be understood that other types of data transmission means may also be used. The GPS receiver 20 provides data representative of location information from signals received from orbiting GPS satellites (not shown) through the co-located antenna 22. The control or signal processor 16 determines if the location quaere from the call center 200 is for a particular asset. If the location quaere relates to a particular asset, then the control or signal processor 16 on that particular asset wakes up or activates the GPS receiver 20 which in turn generates a location signal for transmission by the cellular telephone module 14 to the remote monitoring or response center 100.

Operation

When a particular asset or class of assets is to be located, a call is placed to a pager number by a call center 200. The pager service can be local or nationwide. The pager call consists of a numerical or alpha-numerical message that is sent out to all pagers located on assets within the system. Those pagers affixed to a predetermined category of assets or bearing a matching

code in the memory of the control or signal processor 16 will respond to the outgoing pager call.

Each asset located-pager 12 detects the incoming numerical message or alpha-numerical and wakes up its associated signal or control processor 16. The signal or control processor 16 analyzes the incoming numerical message and determines whether or not the message relates to the particular asset on which the location system is attached. Generally, this is accomplished by matching the received numerical or alpha-numerical message to a numerical or alpha-numerical sequence resident in the memory of the control or signal processor 16. If there is no match, the control or signal processor 16 goes back to sleep or back to its low power mode. If the numerical or alpha-numerical message does relate to the particular asset to which the asset location system 10 is affixed, then the control or signal processor 16 wakes up or activates the GPS receiver 20 to obtain data representing the location of the asset to which the GPS receiver 20 is attached. Since this will most likely be a cold start for the GPS receiver 20, a few moments may be required for the GPS receiver 20 to acquire data from the orbiting GPS satellites and convert these data signals into usable information.

After the GPS location information is acquired by the GPS receiver 20, the modem 18 and the cellular telephone module 14 are powered up and a call is placed to the appropriate monitoring or response center 100. To assure a proper or secure communication link with the monitoring and response center 100 a proprietary communication protocol may be used. When the communication link is established between the cellular telephone 14 and the remote monitoring or response center 100, the location information data and/or asset status data are transmitted to the remote monitoring or response center 100. At the remote monitoring or response center 100, the information describing the location of the asset may be displayed on

a map or relayed to another location as latitude and longitude data. After the remote monitoring or response center 100 has received the transmitted information, the communication link is terminated and the asset location system 10 goes back to sleep or returns to a low power mode of operation.

If no location information can be acquired by the GPS receiver 20 within a preset period of time following the receipt of the page, then the system on board the asset places a cellular telephone call to the remote monitoring or response center 100 to report that fact. This call also tells the remote monitoring or response center 100 that the unit is still functional even if conditions conspire to prevent a GPS location fix from being realized.

If the asset location system 10 of the present invention is wired to a large battery, then there is no need for a photovoltaic cell to generate electricity for the asset location system 10 if that battery is charged regularly. However, with a photovoltaic cell, the asset location system 10 can operate without any external source of power as long as sunlight falls upon the photovoltaic cell for a nominal amount of time each day. A trickle charge could also be provided for photovoltaic powered systems where sunlight is not available on a regular basis.

To reduce costs, no two cellular telephones in an array of locatable assets would be powered up at any one time; specifically, all cellular telephones in the asset location system 10 of the present invention could be clones of one another, but only one would be powered up at any one time. In this way, only one cellular telephone monthly charge could be encountered.

While the asset location system of the present invention has been described by reference to its preferred embodiment, it will be understood by those of ordinary skill in the art that numerous other embodiments of the

present invention will become apparent to those of ordinary skill in the art once having been made aware of the foregoing disclosure. Such other embodiments shall fall within the scope and meaning of the appended claims.

WHAT IS CLAIMED IS:

1. A system for reporting the location of a movable or transportable asset to a response center, said system comprising:

means for receiving a numerical or alpha-numerical signal, said means for receiving a numerical signal affixed to the movable or transportable asset;

a signal processor substantially co-located with said means for receiving a numerical or alpha-numerical signal, said signal processor being activated by a signal received from said means for receiving a numerical signal;

means of providing a signal representative of physical location being substantially co-located with said signal control processor, said means for providing a signal representative of physical location being activated only by a predetermined signal received from said signal processor;

said means for providing a signal representative of physical location being constructed and arranged to provide a signal representative of the physical location of the movable or transportable asset; and

means for transmitting a data signal substantially co-located with said means for providing a signal representative of physical location, said means for transmitting a data signal being constructed and arranged to transmit location information data received from said means for providing a signal representative of physical location to the response center.

2. The system as defend in Claim 1 wherein said means for receiving a numerical or alpha-numerical signal is a pager.

3. The system as defined in Claim 1 wherein said means for transmitting a data signal is a cellular phone module.

4. The system as defined in Claim 1 wherein said signal processor further includes means for matching said received signal with a predetermined signal.

5. The system as defined in Claim 4 further including means to actuate said means for providing a signal representative of physical location and said means for transmitting a data signal when said received signal matches said predetermined signal.

6. The system as defined in Claim 1 further including means for sensing a condition or status of the movable or transportable asset and providing data describing said condition of the movable or transportable asset to said signal processor for transmission to the response center by said means for transmitting a data signal.

7. The system as defined in Claim 1 wherein the normal operation of said system is in a low power or sleep mode.

8. The system as defined in Claim 7 further including means for restoring said system to a low power or sleep mode following the transmission of a signal by said means for transmitting a data signal.

9. The system as defined in Claim 1 wherein said means for providing a signal representative of physical location is a GPS receiver.

10. The system as defined in Claim 1 further including a photovoltaic cell for providing electrical power to the other components in the system.

11. A method for locating a particular asset in an array of assets, said method comprising the steps of:

initiating a pager call by a call center to the array of assets ;

receiving said pager call by a pager located on an asset;

activating a signal or control processor upon the receipt of said pager call;

comparing said pager call with a predetermined pager call stored within said signal or control processor;

activating a GPS receiver if said pager call matches said predetermined pager call stored within said signal or control processor;

obtaining location data from said GPS receiver;

transmitting said location data to a modem; and

transmitting said location data from said modem to a response or monitoring center by a cellular telephone.

12. The method as defined in Claim 11 wherein said signal or control processor is placed in a lower power or sleep mode if said pager call does not match said predetermined pager call stored within said signal or control processor.

13. The method as defined in Claim 11 wherein a communication protocol is used to establish a communication link between said cellular telephone and said response or monitoring center before said location data is transmitted.

14. The method as defined in Claim 11 wherein said signal or control processor, said GPS receiver, said modem and said cellular telephone are placed in a low power or sleep mode following the transmission of said location data to said monitoring or response center.

15. The method as defined in Claim 11 wherein asset condition status data is transmitted along with said location data to said response or monitoring center.

16. The method as defined in Claim 11 wherein only one cellular telephone in said array of assets is powered up at any one time.

17. The method as defined in Claim 11 further including the step of reporting to the response or monitoring center that no location data is available if no location data is obtained from the GPS receiver.

18. The method as defined in Claim 11 further including the step of displaying the location of the asset on a map.

19. The method as defined in Claim 11 further including the step of relaying said location data from said monitoring or response center to another location.

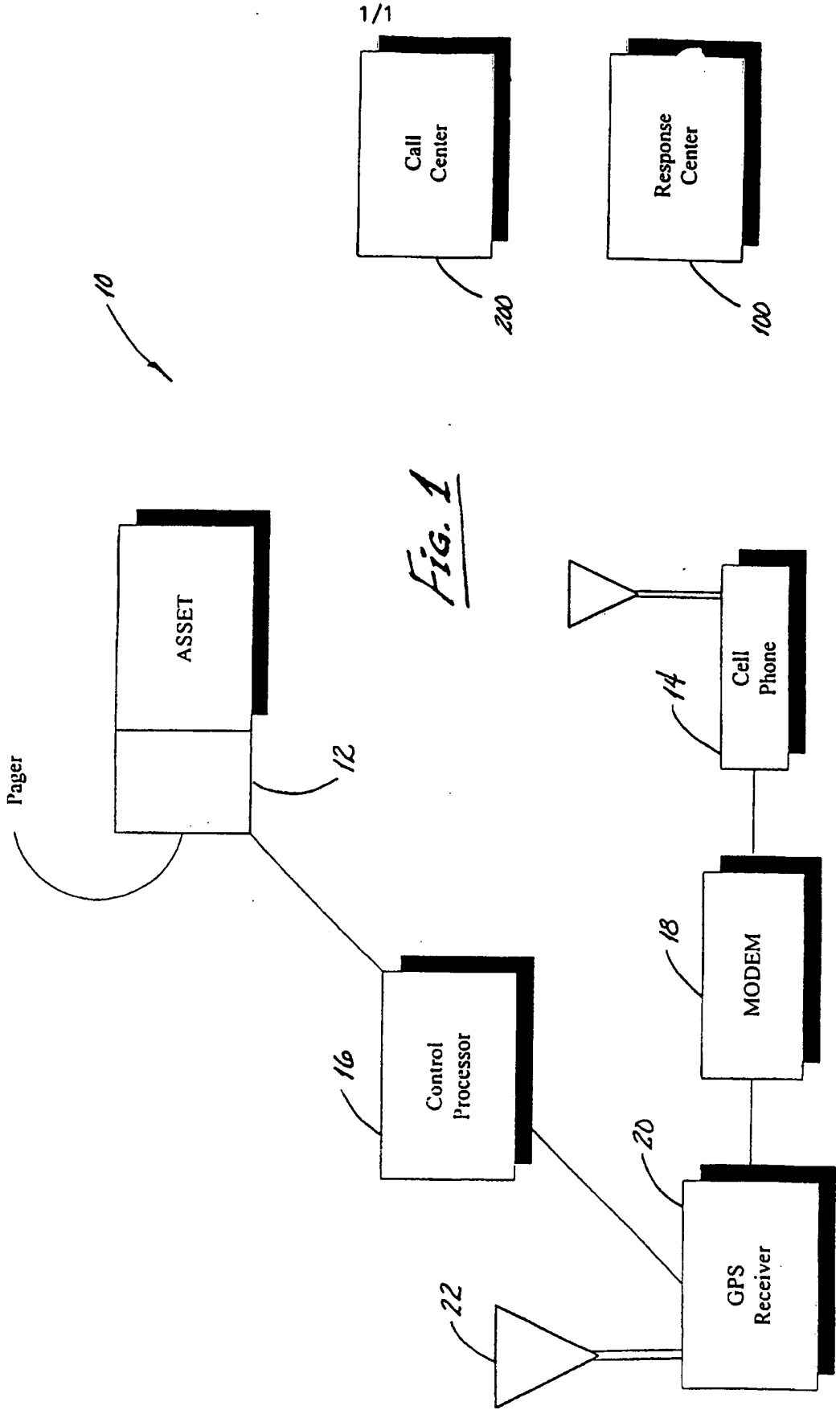
Call Center
200
Response Center
100
10
ASSET
12
Pager
Cell Phone
14
MODEM
18
Control Processor
16
GPS Receiver
20
22

Fig. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/16753

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :H04M 11/00
US CL : 455/422,456

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/427-430, 403, 457

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

NONE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,515,043 A (BERARD ET AL.) 07 May 1996, col. 3-7.	1-19
Y	US 4,742,357 A (RACKLEY) 03 May 1988, col. 3, line 31-col.8, line 62.	1-2,4-8,11-13,15-16, 18-19
Y	US 5,355,511 A (HATANO ET AL) 11 October 1994, col. 2, line 43 - col. 6, line 60.	1-2,4-8,11-13,15-16, 18-19

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Form PCT/ISA/210 (second sheet)(July 1992)*